

(19) World Intellectual Property
Organization
International Bureau



(43) International Publication Date
15 April 2004 (15.04.2004)

PCT

(10) International Publication Number
WO 2004/032233 A1

- (51) International Patent Classification⁷: **H01L 23/495**
- (21) International Application Number:
PCT/IB2003/004134
- (22) International Filing Date:
18 September 2003 (18.09.2003)
- (25) Filing Language: English
- (26) Publication Language: English
- (30) Priority Data:
02079151.3 7 October 2002 (07.10.2002) EP
- (71) Applicant (for all designated States except US): **KONINKLIJKE PHILIPS ELECTRONICS N.V. [NL/NL]**; Groenewoudseweg 1, NL-5621 BA Eindhoven (NL).
- (72) Inventor; and
- (75) Inventor/Applicant (for US only): **HOEF SMIT, Jozeph, P., K. [NL/NL]**; c/o Prof. Holstlaan 6, NL-5656 AA Eindhoven (NL).
- (74) Agent: **DUIJVESTIJN, Adrianus, J.**; Philips Intellectual Property & Standards, Prof. Holstlaan 6, NL-5656 AA Eindhoven (NL).

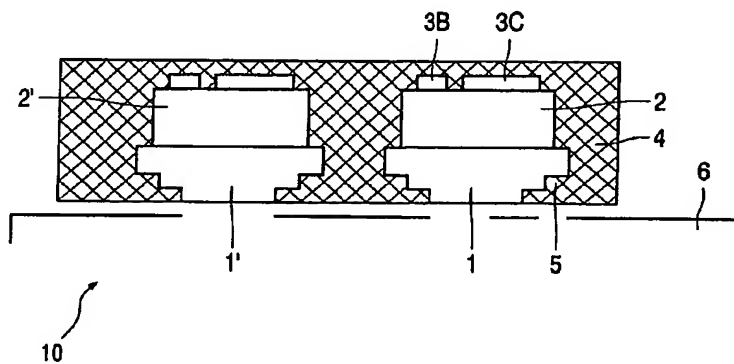
- (81) Designated States (national): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.
- (84) Designated States (regional): ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PT, RO, SE, SI, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Declaration under Rule 4.17:

— as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii)) for the following designations AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD,

[Continued on next page]

(54) Title: SEMICONDUCTOR DEVICE AND METHOD OF MANUFACTURING THEREOF



(57) Abstract: The invention relates to a semiconductor device (10) comprising an electrically conductive bottom plate (1) on an upper side of which a semiconductor element (2) is positioned with a first connection region and a second connection region and with a first conductor and a second conductor, part of which is connected to, respectively, the first and the second connection region of the semiconductor element (2), the semiconductor element (2) and the parts of the conductors connected to the semiconductor element (2) being provided with an electrically insulating resin encapsulation (4) that covers a side face of the bottom plate (1), and the side face of the bottom plate (1) being provided, at the bottom face of the bottom plate (1), with a cavity (5) which is filled with a part of the encapsulation (4). According to the invention, the cavity (5), viewed in a direction transverse and perpendicular to the edge of the bottom plate (1), has the form of a staircase with to steps. In this way it is achieved that during the formation of the encapsulation (4), which at this stage is still liquid, said encapsulation (4) overflows a part of the bottom face of the bottom plate (1). Thus, the resulting device (10) can be mounted flat and with excellent heat sink capability of the bottom plate (1). Preferably, the semiconductor device (2) comprises a discrete power device such as a (LD)MOSFET. The invention further comprises a cheap and easy way of manufacturing a device according to the invention.



MG, MK, MN, MW, MX, MZ, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, UZ, VC, VN, YU, ZA, ZM, ZW, ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PT, RO, SE, SI, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG)

Published:

— with international search report

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.